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ABSTRACT

Inclass Reactive Language (INREAL) was a Handicapped Children's Early Education Program (HCEEP) funded demonstration model to improve the language and related learning skills of 3 to 5 year old language handicapped and bilingual (Spanish) children by a naturalistic, nonstigmatizing method. A second goals was to redefine the role of the speech language pathologist who works with preschool and kindergarten children. Three procedures were used to evaluate the major objectives: experimental study to measure language development, longitudinal experimental study to measure the effectiveness of early identification and intervention in prevention of later language related learning problems, and cost effectiveness study to demonstrate efficacy. Third year demonstration grant results on matched experimental and control groups show that INREAL intervention effects highly significant language improvement in the experimental (INREAL) groups. The longitudinal data, gathered for 3 years after the INREAL intervention program had ended, show that use of the INREAL method at the preschool and kindergarten level results in the need for substantially fewer followup remedial services and fewer retention in grade placements. The longitudinal data have been translated into cost effectiveness based on Colorado Department of Education cost for special education services and show a per pupil saving of $1,108.76, including the instructional cost of INREAL treatment. (Author/SB)

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Efficacy and Cost Effectiveness of an Early Intervention Program for Young Handicapped Children

Efficacy Presentation

at

Handicapped Children's Early Education
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Shoreham Hotel, Washington, D.C.

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Efficacy of INREAL Intervention for Preschool and Kindergarten Language Handicapped and Bilingual (Spanish) Children.

INREAL (INclass REActive Language) was an HCEEP funded demonstration model project in 1974-77. The INREAL model is based on the innatist theory of language learning*. This theory, a modification of the rationalist-nativist view, suggests that:

1. all children have a biological predisposition for learning language.
2. environment acts on the predisposition.
3. the best environment for language learning is one which cultivates the opportunity for free interactions of an active learner, objects and people.

The major goal of the INREAL project was to improve the language and related learning skills of 3-5 year old language handicapped and bilingual (Spanish) children by a naturalistic, non-stigmatizing method. A second goal was to redefine the traditional, instructive role of the speech-language pathologist who works with preschool and kindergarten children.

The INREAL Method

The INREAL method places the speech-language specialist in an applied innatist situation as a reactive partner in the language learning process. Thus, the INclass component of the INREAL method reverses the traditional therapy process, i.e., the specialist goes to the child rather than having the child come to the specialist. The INREAL specialist is in the classroom (the child's natural environment) daily as a resource, auxiliary teacher. This reversed therapy process ("out of the clinical closet") is non-stigmatizing for the language impaired child since the specialist singles out no child either overtly by removal from class for therapy or covertly by direct individual or small group therapy within the classroom. The INclass delivery of service is a new competency for the traditional speech-language pathologist.

The REActive component of the method requires a child-to-specialist, rather than specialist-to-child, orientation and emphasis. The specialist does not

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*See Lindfors, J. W. Children's Language and Learning. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1980.

manipulate the situation in order to elicit predetermined utterances from the child but rather enters into the learning situation by reacting to the child's freely chosen communicative and linguistic repertoire. To become reactive the specialist must first establish an empathic relationship with the language impaired child through S.O.U.L. (Silence, Observation, Understanding, Listening) and the non-verbal technique of mirroring. Then the specialist interacts with the child by using the psycholinguistic techniques of:

(a) self-talk: the specialist talks out her own participation during parallel play with the child.

(b) parallel talk: the specialist talks out the child's participation during parallel play.

(c) verbal monitoring and reflecting: 1. the specialist listens to the child and repeats non-punitively exactly what the child has said. 2. the specialist listens to the child and non-punitively says back correctly what the child has said in error.

(d) expansion: the specialist listens to the child and responds by elaborating on what the child has said.

(e) modelling: the specialist listens to the child and communicates conversationally without necessarily using the child's words.

These techniques, rooted in Piagetian developmental psychology, emphasize the experiential aspects of innatist language learning theory and demand new, early childhood competencies from the speech-language pathologist.

The Language component of the method is concerned with language disorders of semantics (vocabulary), syntax (grammar), phonology (articulation) and pragmatics (language in context). The program is also concerned with meeting the language learning needs of 3-5 year old bilingual (Spanish) children.

The INREAL Project

The INREAL project was designed to demonstrate INREAL treatment feasibility and generalizability in a variety of locations constituting a broad socioeconomic cross-section of Colorado early childhood populations. Table I (below) provides details on locations and subjects of the 1976-77 project when comparative data were collected.

Table I

INREAL Locations: 1976-77

I. Surburban

Type of Agency	No. of Children
Day Care, one parent children	56
Coop. nursery, middle class/professional	38
P. S. Preschool, one day per week	125
Kindergarten (4)	102

II. Rural

Type of Agency	No. of Children
Headstart	18
Bilingual Kindergarten* (2)	64

III. Small City

Type of Agency	No. of Children
Headstart (2)	35
Bilingual Kindergarten* (2)	80

Total Preschool = 272 children in 6 locations
Total kindergarten = 246 children in 8 locations
Total Number of Children = 518

*Bilingual (Spanish) Kindergarten = implemented by school districts under Title VII of ESEA.

Six (6) INREAL Specialists were on staff in the third year of the project 1976-77. Five of the INREAL specialists were M.A. speech-language pathologists with experience in early childhood or mental retardation. Their graduate work was done at four different universities. One specialist held a B.A. in speech-language pathology from one institution and a teaching credential in early childhood education from another institution. One specialist was bilingual (Spanish). INREAL specialist received training in INREAL philosophy and procedures before the school year began an on-going training in INREAL methodology and bilingualism during weekly staff meetings.

The INREAL specialist was in class every day on a split-day basis of mornings in a preschool and afternoons in a "feeder" Kindergarten to which the preschool children would go when age appropriate.* In this way, the specialist worked as a bridge between the private and public sectors and was responsible for serving the range of children found in these settings, verbal as well as language handicapped. In addition, the specialist was available daily as an INREAL model for classroom teachers and parents.

*two specialists served two kindergartens each in addition to their single preschools.

Two objectives were set for the INREAL project:

1. to increase children's language development significantly.
2. to prevent later language-related learning problems in mild-to-moderate language handicapped children.

Three procedures were used to evaluate the major objectives of the program: 1) experimental study to measure language change, 2) longitudinal experimental study to measure the effectiveness of early identification and intervention in prevention of later language-related learning problems and 3) cost effectiveness study of longitudinal data to demonstrate efficacy. These procedures were applied to the total subject pool and to the bilingual (Spanish) subject population.

1. Experimental Study 1976-77

Design: The experiment employed a randomized block design with both experimental and control groups receiving pre and post measurement. The blocks were pairs of classrooms matched on age and sex of children served, socioeconomic status, bilingual status and class meeting time (A.M. or P.M.). Within each matched pair, classrooms were randomly assigned to treatment (INREAL) and Control conditions. The INREAL specialists were randomly assigned to the INREAL classrooms. One third of the children in INREAL and Control classrooms were selected randomly for pre and post measurement.

Measures: Language capabilities of subjects were determined by the Fluharty INREAL Preschool Screening Test (FIPS), adapted from the original Fluharty Screening Test for Preschool Children by Nancy Fluharty, Journal of Speech and Hearing Disorders, Feb. 1974, pp. 75-88. The FIPS is a 10-minute individually administered language screening test for ages 3-6, composed of four subtests on Identification, Articulation, Comprehension and Repetition. Scoring on the FIPS includes an overall rating of PASS/FAIL and subtest ratings. Fluharty had standardized the test on over 1,000 Ohio children, Black and Caucasian, and included norms for Black dialect in the Articulation section. The FIPS adaptation includes norms for Colorado bilingual (Spanish) subjects in the Articulation section. (Atlas-Klein, D., J. Wallace and R.S. Weiss, unpublished manuscripts, University of Colorado, Boulder, 1975-80).

The FIPS was selected because it is: 1) appropriate to early childhood. The first three subtests utilize familiar concrete objects; the abstraction of pictures is not used until the final subtest. Also, the FIPS is a short, individually administered test that minimizes fatigue and over-referral. 2) a screening instrument. INREAL supports the minimal language testing of early childhood populations; hence, diagnostic tests were not used in the study. 3) representative of INREAL philosophy and criterion referenced; i.e., the FIPS measures the components of Reactive Language Therapy; 4) psycholinguistic. The four subtests assess

(a) vocabulary (Identification), (b) phonology (Articulation), (c) receptive syntax (Comprehension) and (d) expressive syntax (Repetition); 5) standardized. It has cut-off norms for 3-6 year olds and 6) valid and reliable. Intra (average reliability = 0.97) and inter (average reliability = 0.96) tester reliability had been established by Fluharty using the Pearson product-moment correlation method. Validity was established between the Fluharty screening test, the Goldman Fristoe Test of Articulation and the Northwestern Syntax Screening Test. The Pearson product-moment correlation coefficient of validity was 0.87.

A random sample, one-third of experimental and control subjects, was screened using the FIPS in September (pre) and May (post) by University of Colorado speech-language pathology students not connected with the INREAL research project. Screeners were trained by the INREAL staff to administer the FIPS test in the same way.

Analysis: Analysis of covariance (randomized block) was used to test for post-test group differences on the FIPS test, controlling for any pre-test group differences due to sampling error.

For each subsection of the FIPS, a child received a score corresponding to the number of correct responses on that section. An age adjusted score was computed which allowed (1) direct comparison of scores across age groups, (2) computation of continuous, rather than dichotomous, age corrected scores, and (3) computation of a continuous overall FIPS score. Each subsection score (number of correct responses) was divided by the age corrected pass/fail cut-off score for that subsection, and multiplied by 100. This yielded a score indicating what percentage of the pass/fail cut-off each child achieved for his or her age group. All scores were thereby automatically corrected for age differences. For example, two children of different ages may have different numbers of correct responses on a subsection, yet both receive scores of 120%, indicating that each scores 120 percent of their age group's pass/fail cut-off.

$$\text{Percentage score} = \frac{\text{\# of successes}}{\text{age corrected pass/fail cut-off}} \times 100$$

Overall FIPS test scores were computed as the average of all the subsection percentage scores.

Results:

A. Overall Analysis

Table II

INREAL Experimental Study 1976-77
(Group Posttest Means on FIPS Test)

	PRESCHOOL		
	INREAL (59)	Control (55)	p
Identification	114	111	.24
Articulation	123	119	.027*
Comprehension	126	120	.028*
Repetition	139	122	.003*
TOTAL	126	118	.001*
	KINDERGARTEN		
	INREAL (46)	Control (63)	p
Identification	109	104	.001*
Articulation	114	110	.001*
Comprehension	120	114	.002*
Repetition	127	113	.001*
TOTAL	118	110	.001*

*significant

The overall preschool and kindergarten data reveal that INREAL treatment effected marked language performance gains in both INREAL preschool and kindergarten groups for the period studied. This result is supported by significant between-group differences favoring the INREAL group on seven of the eight subtests of the Fluharty INREAL Preschool Screening test (FIPS). For the preschool analysis, INREAL treatment was found effective on three of the four FIPS subtests and on the Total test score; the difference between preschool experimental and control groups on the Identification subtest was not significant. The kindergarten analysis shows significant differences in the INREAL direction on all FIPS subtests and on the Total test score.

B. Bilingual (Spanish) Analysis

Table III

INREAL Bilingual (Spanish) Experimental Study 1976-77
(Group Posttest Means on FIPS Test)

	PRESCHOOL		
	INREAL (11)	Control (14)	p
Identification	102	102	.982
Articulation	118	118	.436
Comprehension	114	108	.050*
Repetition	126	117	.060
TOTAL	115	111	.047*
	KINDERGARTEN		
	INREAL (20)	Control (18)	p
Identification	109	99	.014*
Articulation	114	111	.163
Comprehension	121	107	.064
Repetition	127	113	.094
TOTAL	118	108	.020*

*significant

The bilingual (Spanish) data, extracted from the overall data, indicate that INREAL treatment effected language performance gains in the bilingual preschool and kindergarten groups as supported by significant between-group differences favoring the INREAL groups on the Total test scores. In the bilingual preschool analysis, the Comprehension subtest difference was a significant finding in the INREAL direction. In the bilingual kindergarten analysis, the Identification subtest difference was a significant finding in the INREAL direction.

2. Longitudinal Experimental Study

Design: The Longitudinal Experimental Study employed a randomized block design with post measurement over three years. The randomization procedures are described in the Experimental Study section. All children who had been selected for pre and post testing during the initial study were followed over three years to determine whether they had received subsequent special remedial services provided by the schools. Attrition for the INREAL group was 35% and 33% for the Control group.

Measures: The data were gathered from regular and special education school records by University of Colorado Department of Communication Disorders and Speech Science graduate students who were blind to the group membership of the subjects. Special remedial service placement had been made by local school district personnel prior to the INREAL longitudinal investigation and had been decided on the basis of school district screening and referral procedures. The identity of the handicapped children who had received earlier INREAL treatment was protected from the

permanent school records in three of the four districts studied, as ascertained by phone and personal conversation with the Directors of Special Education. The special remedial services supplied to the study population included: speech-language, resource room (remedial reading and perceptual communicative/learning disabilities - PCLD), retention-in-grade (including Special Kindergarten placement), emotionally disturbed-behavior disordered (EDBD) and educable mentally retarded (EMR).

Analysis: Chi square statistics were used to measure the relationship between membership in INREAL and Control groups and the receipt of special services in the three years following the experiment.

Results:

A. Overall Analysis

Table IV

INREAL LONGITUDINAL EXPERIMENTAL STUDY
Percentages (Number) of 1976-77 INREAL & Control Group Receiving Special Services in the Following Three Years:

	1977-78		
	INREAL	Control	p
Speech-Language	12% (13)	29% (31)	.002*
Resource Room[1]	9% (10)	15% (16)	.403
Retention-in-Grade[2]	4% (4)	11% (12)	.033*
EDBD[3]	1% (1)	0	.321
EMR	0	0	
	1978-79		
	INREAL	Control	p
Speech-Language	14% (15)	31% (32)	.003*
Resource Room	10% (11)	28% (29)	.004*
Retention-in-Grade	4% (4)	10% (10)	.086
EDBD	2% (2)	3% (3)	.628
EMR	0	1% (1)	.309
	1979-80		
	INREAL	Control	p
Speech-Language	10% (9)	25% (22)	.007*
Resource Room	9% (8)	24% (21)	.019*
Retention-in-Grade	2% (2)	2% (2)	.973
EDBD	1% (1)	3% (3)	.296
EMR	3% (2)	2% (2)	.921

*significant

[1] remedial reading + PCLD

[2] Special Kindergarten

[3] emotionally disturbed-behavior disordered

[4] educable mentally retarded

The longitudinal percentage data indicate that INREAL was effective in preventing later learning problems that are language related. The experimental group required substantially fewer Speech-Language and Resource Room (remedial reading and PCLD) special services for each of the three years studied after INREAL treatment ended, except for Resource Room services in 1977-78. The 1977-78 Retention-in-Grade (with Special Kindergarten placement) results indicate that there were significant between-group differences favoring the INREAL group. There were no differences for 1978-79 and 1979-80 Retention-in-Grade groups. Results on EDBD and EMR services show no between-group differences for the three years studied, as expected. (See Discussion section.)

Table V

INREAL LONGITUDINAL EXPERIMENTAL STUDY
Total Number of Special Services to 1976-77 INREAL & Control Group

	Total 1977-80		
	INREAL	Control	p
Speech-Language	37	85	.001*
Resource Room	29	66	.003*
Retention-in-Grade	10	24	.007*
EDBD	4	6	.140
EMR	2	3	.488

*significant

The longitudinal number of special services data indicate that INREAL was effective in preventing later language-related learning problems (Speech-Language and Resource Room) and reducing retention-in-grade for the three years studied. Results on EDBD and EMR services show no between-group differences for the three years studied, as expected. (See Discussion section.)

B. Bilingual (Spanish) Analysis

Table VI

BILINGUAL LONGITUDINAL EXPERIMENTAL STUDY
Percentages (Number) of 1976-77 Bilingual (Spanish) INREAL and Control Group Receiving Special Services in the Following Three Years:

	1977-78		
	INREAL	Control	p
Speech-Language	5% (2)	42% (13)	.001*
Resource Room	9% (4)	23% (7)	.113
Retention-in-Grade	7% (3)	10% (3)	.675
EDBD	2% (1)	0	
EMR	0	0	
	1978-79		
	INREAL	Control	p
Speech-Language	5% (2)	43% (13)	.001*
Resource Room	10% (4)	53% (16)	.001*
Retention-in-Grade	2% (1)	20% (6)	.013*
EDBD	2% (1)	3% (1)	.808
EMR	0	0	
	1979-80		
	INREAL	Control	p
Speech-Language	0	43% (9)	.001*
Resource Room	6% (2)	47% (10)	.001*
Retention-in-Grade	0	5% (1)	.199
EDBD	3% (1)	5% (1)	.726
EMR	3% (1)	5% (1)	.726

*significant

The bilingual (Spanish) longitudinal percentage data, extracted from the overall longitudinal data, indicate that INREAL was effective in preventing later, language related learning problems in the bilingual children studied. These results show that the experimental group required substantially fewer Speech-Language services for the three years. Fewer Resource Room (remedial reading and PCLD) services were required by the experimental group in 1978-79 and 1979-80. Results on 1978-79 Retention-in-Grade data show that the experimental group required substantially fewer services than the control group. Results on EDBD and EMR services show no between-group differences for the three years studied, as expected. (See Discussion section.)

Table VII

BILINGUAL LONGITUDINAL EXPERIMENTAL STUDY
Total Number of Special Services to 1976-77 Bilingual (Spanish)
INREAL and Control Group

	TOTAL 1977-80		
	INREAL	Control	p
Speech-Language	4	35	.001*
Resource Room	10	33	.003*
Retention-in-Grade	4	10	.002*
EDBD	3	2	.332
EMR	1	1	.750

*significant

The bilingual (Spanish) total number of special services data indicate that INREAL was effective in preventing later language-related learning problems (Speech-Language and Resource Room) and reducing retentions-in-grade for the three years studied. Results on EDBD and EMR services show no between-group differences for the three years studied, as expected. (See Discussion section.)

3. Cost Effectiveness Study

The longitudinal percentage data for the overall group from Table IV and the bilingual (Spanish) group from Table VI were translated into per pupil cost, as based on Colorado Department of Education average instructional costs for special services for each of the three years studied, 1977-80.* The per pupil instructional cost for the 1976-77 INREAL program was also determined.

*See Appendix A for Colorado Department of Education costs and cost computation.

Results

A. Overall Analysis

Table VIII

Per Pupil Cost Of Three Year Follow Up Special Services
For 1976-77 INREAL and Control Group*

1977-78

	INREAL	Control	Dif.
Speech-Language	$ 50.40	$121.80	$ 71.40
Resource Room	167.58	279.30	111.72
Retention-in-Grade	61.00	167.75	106.75
EDBD	23.67	xxx	-23.67
EMR	xxx	xxx	xxx
			$266.20**

1978-79

	INREAL	Control	Dif.
Speech-Language	$ 69.30	$153.45	$ 84.15
Resource Room	200.40	561.12	360.72
Retention-in-Grade	61.00	152.50	91.50
EDBD	49.04	73.56	24.52
EMR	xxx	19.82	19.82
			$580.71

1979-80

	INREAL	Control	Dif.
Speech-Language	$ 57.00	$142.50	$ 85.50
Resource Room	193.59	516.24	322.65
Retention-in-Grade	35.20	35.20	xxx
EDBD	25.37	76.11	50.74
EMR	66.12	44.08	-22.04
			$436.85

Total Dif. = $1,283.76

*based on Colorado Dept. of Education cost
**N.B. per pupil INREAL 1976-77 instructional cost was $175

These results show that INREAL intervention made a $1,283.76 per pupil difference and cost saving for the three years studied.

B. Bilingual (Spanish) Analysis.

Table IX

Per Pupil Cost Of Three Year Follow-Up Special Services for 1976-77 Bilingual INREAL & Control Group*

	1977-78		
	INREAL	Control	Dif.
Speech Language	$ 21.00	$176.40	$155.40
Resource Room	167.58	428.26	260.68
Retention-in-Grade	106.75	152.50	45.75
EDBD	47.34	xxx	- 47.34
EMR	xxx	xxx	xxx
			$414.49**

	1978-79		
	INREAL	Control	Dif.
Speech Language	$ 24.75	$212.85	$188.10
Resource Room	200.40	1,062.12	861.72
Retention-in-Grade	30.50	305.00	274.50
EDBD	49.04	73.56	24.52
EMR	xxx	xxx	xxx
			$1,348.84

	1979-80		
	INREAL	Control	Dif.
Speech Language	xxx	$ 245.10	$ 245.10
Resource Room	$ 129.06	1,010.97	881.91
Retention-in-Grade	xxx	88.00	88.00
EDBD	76.11	126.85	50.74
EMR	66.12	110.20	44.08
			$1,309.83

	TOTAL DIF. =	$3,073.16

*based on Colorado Dept. of Education cost
**N.B. per pupil INREAL 1976-77 instructional cost was $175

These results show that INREAL intervention made a $3,073.16 per bilingual (Spanish) pupil difference and cost saving for the three years studied.

Discussion

1. Experimental Study 1976-77.

A. Overall Analysis

The Experimental Study included data on the INREAL (experimental) and Control subjects from matched classrooms. The size of the original INREAL sample pool (N = 518) was reduced (N = 105) because of random selection and prepost testing absences. Analysis of covariance was used with pretest scores as the covariant to control for any sampling bias.

The overall preschool and kindergarten data show that INREAL treatment increases children's language development significantly, as evidenced by the marked gains in experimental Total test scores and in seven of the eight subtest scores (see Table II).

The non-significant finding for the preschool group on the Identification (vocabulary) subtest seems to reflect the more limited vocabulary competence of a preschool population since results on the same subtest for the older (kindergarten) group were significantly different in the INREAL direction.

B. Bilingual (Spanish) Analysis.

The Total test scores for the bilingual (Spanish) preschool and kindergarten group show that INREAL treatment increases bilingual children's general language development (see Table III). The preschool Comprehension results indicate that INREAL was effective in improving the receptive language (syntax) of the subgroup. The kindergarten Identification results indicate that INREAL increases the vocabulary skills of the subgroup. The absence of significant between-group differences on the preschool Identification, Articulation and Repetition subtests and on the kindergarten Articulation, Comprehension and Repetition subtests may reflect the small number in the bilingual subgroup.

2. Longitudinal Experimental Study 1977-80.

A. Overall Analysis

The project was interested in determining if treatment had long-term educational significance for the experimental group. The longitudinal procedure used was to examine the incidence of special remedial services in the INREAL and Control groups for the three years after treatment to the experimental group was ended.

The finding that the experimental group required substantially fewer Speech-Language, Resource Room (remedial reading and PCLD) and Retention-in-Grade special services for the three years studied is evidence that INREAL demonstrated prevention effectiveness with the target population of mild-to-

moderate early childhood language handicapped children. (See Tables IV and V.)

The non-significant finding for Resource Room special services in 1977-78 may be a reflection of the low incidence of remedial reading and PCLD placement at the primary school level. (See Table IV.)

The 1987-80 Retention-in-Grade results may also be a reflection of low incidence. On the other hand, the 1977-78 Retention-in-Grade findings of somewhat higher incidence seem to support the Colorado educational policy that retention-in-grade at the earliest possible level is preferred.

Results on the EDBD and EMR services show no between-group differences for the three years studied. These results were expected because EDBD and EMR are self-contained special education classrooms serving more involved handicapped populations than the INREAL target population. Also, the incidence of these services was low.

B. Bilingual (Spanish) Analysis

The finding that the experimental group required substantially fewer Speech-Language, Resource Room (remedial reading and PCLD) and Retention-in-Grade total special services for the three years studied is evidence that INREAL demonstrated prevention effectiveness with the bilingual (Spanish) group of children despite the small sample size. (See Table VII.) The non-significant finding for the 1977-78 Resource Room special services reflects similar findings for the overall group as discussed above. The Retention-in-Grade findings for each of the three years studied may reflect not only the small sample size but also the Colorado educational policy to retain-in-grade at the earliest possible level (See Table VI).

Results on the EDBD and EMR services for the bilingual (Spanish) group show no between-group differences for the three years studied. As discussed above, the results were expected because these are low incidence classrooms serving more involved handicapped populations than the INREAL target population.

3. Cost Effectiveness Study.

The per pupil costs for the special services delivered in 1977-80 were calculated from the longitudinal percentage findings in Table IV and Table VI and were based on average instructional costs for special services from the Colorado Department of Education. The cost analyses show that INREAL treatment effected considerable per pupil dollar savings for each of the three years studied and that the per pupil cost of INREAL treatment was absorbed within one year after treatment had ended. (See Table VIII.)

The bilingual per pupil costs for 1977-80 special services show that INREAL treatment effected even greater dollar savings for each of the three years studied, i.e., that INREAL treatment results in quality bilingual education for bilingual (Spanish) children. (See Table IX.) Again, the cost of the INREAL treatment was absorbed within one year after treatment had ended.

Summary

It is felt that INREAL has been tested widely enough under sufficiently diverse circumstances to give assurance that INREAL treatment is effective in increasing children's language development. The longitudinal and cost findings demonstrate that INREAL is effective as an early identification and early intervention program in the prevention of later, more costly language-related learning problems with 3-5 year old language handicapped and bilingual (Spanish) children. Therefore, we feel justified in urging educational administrators to support early childhood INREAL intervention as efficacious.

Appendix A

Average Colorado Department of Education Per Pupil Cost
For Special Services

	1977-78	1978-79	1979-80
1. Speech-Language	$ 420	$ 495	$ 570
2. Remedial Reading	730	800	875
3. PCLD	1,132	1,204	1,276
4. Resource Room (2+3)	1,862	2,004	2,151
5. EDBD	2,367	2,452	2,537
6. EMR	1,760	1,982	2,204
7. Retention-in-Grade	1,525	1,525	1,760

Computation of Per Pupil Costs in Longitudinal Analysis

The first line of results from Table IV will be used to provide an example of the calculation of per child longitudinal costs for special services:

	1977-78		
	INREAL	CONTROL	p
Speech-Language	12% (13)	29% (31)	.002

The aim of the analysis is to determine the relative costs of special services required by the average pupil in the INREAL and CONTROL groups for each of the three years. If the groups were of equal size, these relative costs could be calculated based on the relative numbers of INREAL and CONTROL pupils receiving services. However, since the groups differed in size, the relative percentages were used as a base for computing average per child costs.

To compute average costs for 1977-78, the per child cost of Speech-Language for 1977-78 ($420) is multiplied by the percentage of children in each group receiving Speech-Language (12% for INREAL; 29% for CONTROL) yielding $50.40 for INREAL and $121.80 for CONTROL for a difference of $71.40. These costs represent per child costs of services, given the relative likelihood (probability) that children in the INREAL vs CONTROL group will require these services. The expected cost per child for the CONTROL group is therefore higher because a greater proportion of CONTROL pupils required Speech-Language services.

Likewise, the difference in cost represents a per child difference, i.e., for each child given INREAL treatment, the data show a savings of $71.40 over a child not given treatment. The $71.40 savings occurred in the Speech-Language services area in the first year. Additional savings accrued from other services, and in subsequent years, as shown in Table IV.